TUBERCULIN TEST CONVERSION AMONG EMPLOYEES OF A TERTIARY CARE HOSPITAL IN RIYADH, SAUDI ARABIA

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Background: The objective of this study was to determine the tuberculin skin test conversion rate, as well as the course and outcome of the converters, among employees of a tertiary care hospital. The study is a retrospective, cohort descriptive study undertaken at the King Faisal Specialist Hospital and Research Centre, in Riyadh, Saudi Arabia.

Patients and Methods: The study was undertaken over a four-year period from 1993 to 1996, and the subjects were employees who had annual screening PPD skin tests. The outcome measures skin test conversion, prophylactic treatment with isoniazid (INH), side effects, and development of clinical tuberculosis.

Results: A total of 6883 tuberculin skin tests were performed during the study period. The mean annual conversion rate was 1.55%. About 78% of the converters received INH prophylaxis, but only 75% of those who started chemoprophylaxis completed the course. The side effects of INH treatment were found in 23% of those on treatment, and one of the converters developed clinically active tuberculosis during the study period.

Conclusion: At the King Faisal Specialist Hospital and Research Centre, the mean annual tuberculin skin test conversion rate among employees is similar to that found in other studies, but compliance to oral isoniazide prophylaxis is low. There is a need to develop strategies to improve compliance.

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Key Words: Tuberculin skin test, converters.

The World Health Organization reported that in 1992, one-third of the world's population, 1.7 billion people, were infected with tuberculosis (TB), and that 2.9 million patients died of tuberculosis during that year.[1] Al-Kassimi et al.[2] used the parameter of a positive tuberculin test of 10 mm or more in the first comprehensive and nationwide survey with urban/rural stratification in Saudi Arabia, and found that in the general population, 33% of subjects were infected, peaking to 56% in those aged 45 years and older. The average prevalence in children aged 5-14 years (more representative of recent trends) was 6%. Eighty-three patients with smear- and/or culture-positive pulmonary tuberculosis were treated at the King Faisal Specialist Hospital and Research Centre (KFSH&RC) during the period 1993 to 1996.

Although most of the infection all over the world was centered in the community, nosocomial outbreaks of TB involving both patients and health care workers have been well documented.[3,4] The number of patients with TB continues to rise due to many new epidemiological variables, and family physicians are discovering that screening for TB is not a simple routine in the 1990s.[5]

Purified protein derivative (PPD) skin testing remains the single best screening tool to determine recent exposure to *Mycobacterium tuberculosis.*[6] Documentation of skin test conversion, as evidenced by an increase of 10 mm over a previous PPD test over a period of two years, is considered an indication for six months of isoniazide (INH) therapy.[7] The risk of developing active TB is greatest during the two years following conversion,[8] although only about 5% of infected subjects develop active disease in the first two years following infection, with about another 5%-10% developing active disease during the rest of the subject's life.[9]

The aim of this study was to determine the annual PPD skin test conversion rate, outcome of treatment, and disease progression in the converters among employees of KFSH&RC.

Patients and Methods

This is a retrospective, cohort descriptive study undertaken between 1993 and 1996, from the Family Medicine clinical records of KFSH&RC, a 583-bed tertiary care hospital, with a total staff of 6487, comprising 58 different nationalities. All employees at this institution undergo annual PPD skin testing unless there is a documented history of a previous positive test. Two-step

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skin testing to avoid the "booster" phenomenon was implemented in 1994. The following data on each case (converter) was recorded: demographic data (age, gender, nationality, work description); measurement of the previous and latest induration of the PPD skin test; history of BCG administration and TB contact; associated medical conditions; whether INH prophylaxis was offered and taken; and side effects of INH treatment.

The PPD skin test was performed by trained and experienced nursing personnel in the Family Medicine Department. Five tuberculin units of purified protein derivative were administered by intradermal injection on the volar surface of the left arm. The result was assessed after 48-72 hours and the diameter of the induration (not erythema) recorded in millimeters.[10] PPD skin test conversion was defined as an induration of 10 mm or more increase from previous skin test within a two-year period. PPD converters were usually offered prophylactic treatment with INH, and pyridoxine per os daily for six months, after being counselled on the reasons for prophylaxis, side effects and symptoms indicative of active tuberculosis.

PPD converters who elected to start prophylaxis underwent baseline liver function tests. Each patient was evaluated clinically and biochemically (liver function tests), on months 1, 3 and 6 of treatment, and telephone inquiries were made to ensure compliance, to determine side effects of INH, and identify symptoms indicative of active tuberculosis. At the end of the two-year period from the start of prophylaxis and/or skin test conversion, most of the converters were contacted to inquire about their health status and possible disease progression. We were not able to contact eight converters because they had terminated their employment at KFSH&RC. The data were analyzed with the EpiInfo Version 6.04b computer program (CDC, Atlanta, GA), and a *P*-value of 0.05 or less was considered statistically significant.

Results

During the four-year study period (1993-1996), 6883 employees underwent tuberculin skin tests and 107 (1.55%) converted to positive skin tests. Of these, 41 (39%) were female. The majority of the converters (75%) were non-Saudi nationals. The number of converters by nationalities is presented in Table 1. The majority of conversions (68%) occurred in personnel with no direct patient care. The number of converters by work location is presented in Table 2.

The mean annual conversion rate for the study period was 1.55%. The conversion rate for 1993 was 1.19%, 1994 was 1.92%, 1995 was 1.65%, and 1996 was 1.52%. The mean increase in the diameter of the PPD induration was 13.2 mm (range 10-23). A positive history of BCG vaccination was confirmed by 39 converters (36.4%).

Eighty-three subjects (78%) received prophylactic 300 mg isoniazide (INH) oral treatment. The reasons for not taking the prophylactic treatment are presented in Table 3. Of those who took the INH, 20 (23.8%) developed elevated hepatic enzymes, none developed neuritis, and 10 (9.3%) developed other side effects, such as gastrointestinal upset. One patient developed a chronic productive cough and chronic tiredness, which were later attributed to active pulmonary tuberculosis.

Seventy-two subjects (87%) who had started oral prophylactic treatment reported that they took the medication regularly, but only 62 (75%) completed the whole course of prophylaxis for 6 months.

Discussion

The annual PPD skin test conversion rate of 1.55% found among the employees of KFSH&RC in this study is comparable to findings in other studies. In 1978, Vogler and Burke found a PPD conversion rate of 0.11% in all hospital employees over a five-year study period in Salt Lake City.[11] The PPD conversion rate in all hospital employees at the University of Virginia during 1968 and 1969 was 1.9% annually.[12] Bowden and McDiamond found a range of occupational PPD conversions of 0.01% to 11% per year reported in the literature since the development of isoniazid.[13]

At KFSH&RC, 70% of the employees are non-Saudi nationals and 64% are males, which may explain why most of the PPD converters (75%) are non-Saudis and male (61%). About 85% of the male converters were not involved in direct patient care, whereas 72% of the female converters had direct patient care contact. About 37% of the converters gave a positive history of Bacille Calmette-Guérin (BCG) vaccination, although the influence of BCG vaccination on the prevalence of PPD skin test conversion and the effect on the interpretation of PPD conversion have not been well studied and clarified. In 1979, the Centers for Disease Control and Prevention (CDC) recommended that the PPD test be interpreted without regard to previous BCG vaccination, and the CDC has not wavered from this recommendation.[14,15] Horowitz et al.,[16] however, demonstrated difficulties in the interpretation of PPD induration among persons immunized with BCG. Most studies have not indicated the BCG status of the health care workers with PPD skin test conversion.[17,18] The majority of documented conversions occurred in personnel with no direct patient care, possibly as a result of

TABLE 1. *Number of converters by nationality (n=107).*

Nationality	Number (%)
Filipino	36
Saudi	26
Sudanese	13
Indian	6
Other	26

TABLE 2. *Number of PPD skin test converters by work location (107).*

Work location	Number (%)
Direct patient care	
Nursing	30
Physicians	3
Cardiac laboratory, ECG	4
Other	2
Total	39 (37)
Indirect patient care	
Housekeeping	7
Office Services	7
Pharmacy	6
Appointments	3
Other	15
Total	38 (36)
No patient care	
Maintenance	13
Security	4
Finance	3
Housing	3
Other	7
Total	30 (27)

TABLE 3. *Reasons for not taking oral prophylactic INH (n=20).*

	Number (%)
INH offered but refused to take it	8 (40)
INH not offered because of:	
Elevated liver enzymes	4
Age >35 years	3
Had BCG	1
Negative acid-fast bacilli	1
Breast-feeding	1
Pregnancy	1
Treatment with carbamazepine	1

community exposure in Saudi Arabia, or during visits to their home countries. One study found that the conversion rate was similar for employees regardless of the degree of patient exposure, suggesting that there is either a low degree of infectivity from patients or a relatively high rate of non-hospital acquired infections.[19] The mean PPD induration size change of 13.2 mm (range 10-23) between the initial and subsequent skin test suggests that many individuals were recently infected with *M. tuberculosis*.[20,21]

The main reason for the screening for tuberculosis by PPD skin testing is to offer chemoprophylaxis to converters.[22] In this study, more than 22% of the converters did not receive prophylactic INH therapy, and more than 25% of those who did start prophylaxis did not complete the whole course of medication. Almost one out of every four patients who took the INH developed hepatic side effects, as detected by mildly elevated liver enzymes (mostly very mild elevation). Other causes of liver enzyme elevation could not be ruled out. There are no specific markers for hepatitis caused by INH.

No association between chronic illness and PPD skin test conversion was found in this study.

Exposure to tuberculosis is an occupational risk for health care workers, especially those employed in hospitals, and therefore screening should be done by annual tuberculin skin tests, especially for those workers living in communities with a high prevalence of tuberculosis. Prophylactic treatment with INH should be offered to skin test converters, and they should be closely monitored for compliance and side effects. The conversion rate found in this study corresponds to that found in other studies, but the fact that about one in four converters did not take oral prophylactic treatment, and more than 25% of those converters who started treatment did not complete the whole course, is a source of concern that should be addressed by the team responsible for the management of these employees. There is an urgent need to devise strategies to improve compliance.

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